



National Aeronautics and
Space Administration

Washington, D.C.
20546

Reply to Attn of **LID**

February 12, 1985

TO: Distribution

**FROM: LID/Chief, International Planning and Programs
International Affairs Division**

**SUBJECT: Attachment to OMB Study on "International Competitive-
ness in Launch Services"**

Attached is an attachment to the subject study.


Margaret G. Finarelli

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State/George Ojalehto

✓ 

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Attachment



National Aeronautics and
Space Administration

Washington, D.C.
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Office of the Administrator

February 11, 1985

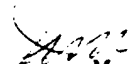
Honorable Robert C. McFarlane
Assistant to the President
for National Security Affairs
Old Executive Office Building
Washington, D.C. 20506

Dear Bud:

Enclosed is an attachment to OMB's interagency study on "International Competitiveness in Launch Services" which was forwarded to you Friday. As Alton Keel noted in his memo to you, this attachment represents NASA's views which were not incorporated in the Working Group's study.

I would appreciate your ensuring that it receives the same distribution as the OMB study. Thank you very much.

Sincerely,


James M. Beggs
Administrator

Enclosure

INTERNATIONAL COMPETITIVENESS IN
LAUNCH SERVICES

SUMMARY

This paper assesses the foreign and domestic commercial demand for space launch services and the international competitiveness of launch systems currently available to serve that demand: the U.S. Space Shuttle, the European Ariane, and the USG-developed expendable launch vehicles (ELV's) which have been made available for operation by the U.S. private sector. It addresses the time period FY1989-91 because the President will shortly be making a decision regarding Shuttle pricing for that period.

The United States is committed to maintaining world leadership in space transportation. This goal is important for national security and foreign policy reasons. It is also important because sales of U.S. space launches and closely associated U.S. satellites mean profit and jobs for U.S. industry; loss of sales denies this business to the U.S. and exacerbates balance of trade problems.

The launch services marketplace is a buyers' market. Each launch system -- Shuttle, U.S. ELV's and Ariane -- is separately capable of satisfying the entire market. And, since the space launch business is extremely sensitive to launch rate

and to production economies of scale, each launch vehicle operator is highly motivated to operate to capacity and thus to capture the entire market.

The United States' competition for world leadership in providing commercial space transportation is Ariane. Ariane has realized a small profit for its operations in 1984 and has also announced even higher full cost recovery prices for the late 1980's. The full cost recovery price of \$87M (82\$) submitted by the NASA Administrator to the President would provide some competition to this higher Ariane pricing, particularly for smaller payloads. U.S. ELV prices are not competitive with Ariane in any payload weight class. In this context, it is important to recognize that Ariane has declared its intention to capture the major portion of the world market in the event that Shuttle prices make the Shuttle non-competitive. Thus, if the U.S. is to maintain its world leadership position in providing commercial space transportation, Shuttle prices must remain competitive. If Shuttle prices are escalated extensively, the Europeans will be in a position to capture as much of the commercial market as they want.

INTRODUCTION

The maintenance of U.S. leadership in space transportation is a central goal of U.S. space policy. The President has designated the Shuttle as the primary space launch vehicle for USG

missions. The President has also directed that the Shuttle be made available for foreign and domestic commercial launches. Beginning in FY 1989, the President has directed that NASA develop a pricing plan to implement full cost recovery for such Shuttle flight operations. To this end, the NASA Administrator has submitted a full cost recovery pricing plan for the period FY1989-91. In the near future, the President will be making a decision regarding full cost recovery pricing.

The purpose of this study is to consider the United States' ability to compete successfully for foreign and domestic commercial launches. This paper looks at the same period (FY1989-91) under consideration in the broader Shuttle pricing study currently underway.

U.S. retention of its leadership role in space transportation is an extremely important policy objective. Both the reality and the perception of leadership have great national security and foreign policy implications. Furthermore, whether Shuttle or U.S. ELV, every U.S. launch means money and jobs for U.S. industry. The Shuttle, while a Government system, is built and operated through contracts with U.S. industry. And the upper stages which permit it to launch commercial telecommunications satellites are completely private ventures. Loss of launches to the Europeans denies this business to U.S. companies. Moreover, the balance of trade implications are severe. Each U.S. satellite owner who buys his launch abroad sends tens of

millions of dollars to Europe. And the loss of the launch is just a part of the impact. The Europeans aggressively and successfully market "package deals" with satellites provided by European manufacturers. Each time a U.S. customer purchases his satellite abroad, he sends to Europe over a hundred million dollars that could have gone to U.S. industry.

BACKGROUND

For many years, the United States Government maintained a monopoly in the provision of launch services for the Free World. In addition to launching USG payloads, the Government provided launches to any customer -- foreign or domestic, government or commercial -- for peaceful purposes. The U.S. monopoly was ended in the 1980's with Europe's development of the Ariane expendable launch vehicle. A further change in the market situation occurred with the 1983 USG decision to offer the private sector the opportunity to assume operation of certain U.S. ELV's (Delta, Atlas/Centaur and Titan). This action was consistent with the shift to the Space Shuttle as the Government's primary space launch system. If privatization of one or more of these U.S. ELV's succeeds, the launch requirements of foreign and domestic commercial entities will be competed for by the Shuttle, the U.S. ELV's and the Ariane. The situation is further complicated by the potential entry into the launch services marketplace of others such as the Japanese and the Soviet Union.

LAUNCH SERVICE DEMAND

The Free World demand for launch services consists of government and commercial payloads. Government payloads are both national security and civil. Commercial payloads include materials processing and other commercial research payloads but are, at present, overwhelmingly telecommunications satellites. The market considered in this paper is the commercial payloads (both foreign and domestic).

The OMB International Competitiveness Working Group has made the following estimate of the demand for commercial launch services in the various payload classes:

Table I - Launch Services Demand

Payload Class:*	<u>89</u>	<u>90</u>	<u>91</u>
PAM-D	9	8	7
PAM-D II	3	4	4
Atlas/Centaur	3	2	3
Large	<u>5</u>	<u>3</u>	<u>5</u>
Total Commercial Payloads	20	17	19
Equivalent Shuttle Flights**	7.8	5.8	7.4

* Payload classes characterize the size the payload being launched in terms of the weight to geosynchronous orbit. PAM-D class payloads are 1200-1400 lbs.; PAM-D II, 1401-2050 lbs.; Atlas/Centaur, 2051-2600 lbs.; Large, 2601-5100 lbs.

** "Equivalent Shuttle Flights" is a term used historically to compare various-sized payloads and launch vehicles by indicating how many Shuttle flights would be required to carry these payloads.

Based on assessments of launch planning by foreign and domestic commercial organizations, NASA believes that at least in the near-term, the market is less than that projected in Table I above. This is due to issues concerning the marketability of direct broadcasting services, prospective competition from terrestrial fiber optic cable systems, the current oversupply of satellite transponders, and concomitant difficulties in obtaining financing. In the future, however, new and innovative commercial uses of space -- much of it probably Shuttle-unique -- could result in an increasing commercial demand for launch services. (Conversely, it is important to note that launch pricing will certainly impact the willingness of the private sector to invest in developing new and innovative uses of space.)

LAUNCH SERVICE CAPACITY

Shuttle Capacity--For purposes of planning, budgeting and calculating costs for reimbursable foreign and commercial flights, NASA has established a baseline of 24 Shuttle flights per year beginning in FY89. This baseline permits a basic investment strategy for Shuttle facilities and components that is closely tied to the President's objective of making the Shuttle fully operational and cost-effective. A flight rate of 24 flights per year is achievable with the currently funded facility investment and with anticipated continuing improvement in launch processing timelines. (In fact, a surge flight rate up to 28 flights per year is achievable considering these

parameters.) The following table reflects NASA and DOD agency projections:

Table II - Shuttle Capacity

	FY89 <u>24-28</u>	90 <u>24-28</u>	91 <u>24-28</u>
STS Baseline Capacity			
Less: Projected USG Payloads			
NASA	7.2	9.3	8.3
DOD	<u>10.3</u>	<u>8.3</u>	<u>9.0</u>
Subtotal	17.5	17.6	17.3
Available for Commercial and Foreign Payloads	6.5-10.5	6.4-10.4	6.7-10.7

Thus, the Shuttle has the capacity to capture the entire market shown in Table I.

Ariane Capacity--The Ariane family of launch vehicles has been developed by the European Space Agency and turned over to the quasi-governmental profit-making organization Arianespace for purposes of management and marketing. European governments and financial institutions are shareholders in Arianespace with the French Government holding 60%. In the post-FY88 period, Ariane 3 and Ariane 4 vehicles will be utilized.

Ariane's current launch rate is seven vehicles per year scheduled through 1987, although the launch pad at the Kourou, French Guiana, launch site is capable of handling eight launches per year. An additional new launch pad for the Ariane 4 vehicle will be operational in mid-1986, doubling Ariane's

launch capacity. With only nominal investments in launcher production and payload processing facilities, a launch rate of 16 Arianes per year is easily achievable.

U.S. ELV experience suggests that increases in production and flight rate would significantly decrease average unit costs to the company due to efficiencies of scale. Arianespace officials have noted that corporate decisions to hold to their lower than achievable production and flight rates represent their estimate of their ability to capture the market under current competitive conditions. Even at current prices, economies of scale argue for increasing capacity if increased market share is likely. Moreover, the probability of Arianespace's investing in additional capacity to meet potential demand rises significantly as the overall level of international pricing for launch services increases.

The following NASA table represents Ariane's easily achievable capacity, minus two launches per year estimated for ESA non-commercial launches:

Table III -- Ariane Capacity

	FY89 14	90 14	91 14
Ariane 3/4 Equivalent Shuttle Flights	7	7	7

Thus, Ariane has the capacity to capture the entire market shown in Table I.

U.S. ELV Capacity--Possible near-term production rates for each U.S. ELV have been provided by the three separate manufacturers of these vehicles. Regarding the capacity of U.S. ELV's, however, it should be noted that the existing lines are sized for and have yielded production rates double those noted below. The following table represents the Working Group's estimate of capacity for the three launchers which have potential for privatization in three separate commercial operations:

Table IV - U.S. ELV Capacity*

	<u>89</u>	<u>90</u>	<u>91</u>
Delta	8	8	8
Atlas	8	8	8
Titan	<u>4</u>	<u>4</u>	<u>4</u>
Total ELVs	20	20	20
Equivalent			
Shuttle Flights	7.6	7.6	7.6

* The numbers in this table do not actually reflect the capacity of U.S. ELV's, but rather they reflect possible near-term production rates. Historically, U.S. ELV capacity has been demonstrated to be double the rates reflected in this table.

Thus, in aggregate, the U.S. ELV's should be capable of capturing the entire market shown in Table I. (It must be

noted, however, that as three separate entities with substantially different capabilities, individual U.S. ELV's cannot operate with the same efficiencies and economies of scale as can the Shuttle and Ariane with their ability to service the full range of payload classes in the market. It should be further noted that the possible near-term production rates for the individual U.S. ELVs do not necessarily correlate with the demand for launch services in the payload range most efficiently served by each of these ELV's. See Table I.)

LAUNCH SERVICE PRICING

Shuttle Pricing--Table V shows Shuttle prices by payload class reflecting the full cost recovery price of \$87M in FY82\$ (\$101.7M in FY86\$) submitted to the President by the NASA Administrator. (The prices include the estimated cost of a standard upper stage to meet the payload requirements. The overall price for the Shuttle, particularly for the larger payloads, can be materially affected by the choice of the upper stage.)

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Furthermore, far from being heavily subsidized as is often claimed, because of both inherent cost advantages and the

historically strong dollar, Arianespace actually turned a profit in 1984--at prices even lower than its "full cost recovery" prices.) The lower price in the range reflects prices Arianespace has actually quoted commercial customers for launches in the post-1987 period, or their estimated full cost as provided to the ongoing USTR investigation of Arianespace.

U.S. ELV Pricing--Table V shows likely prices by payload class as reported to the Working Group by the U.S. companies offering U.S. ELV launches. These prices reportedly include a profit margin; they also arbitrarily assume a launch rate of 4 per year as the minimum level of efficient production. (It should be noted, however, that NASA's experience with Delta and Atlas/Centaur launch vehicles would indicate that higher prices would be required to cover costs, even without considering profit margins.)

Table V -- Launch Services Pricing
(Millions of FY86\$)

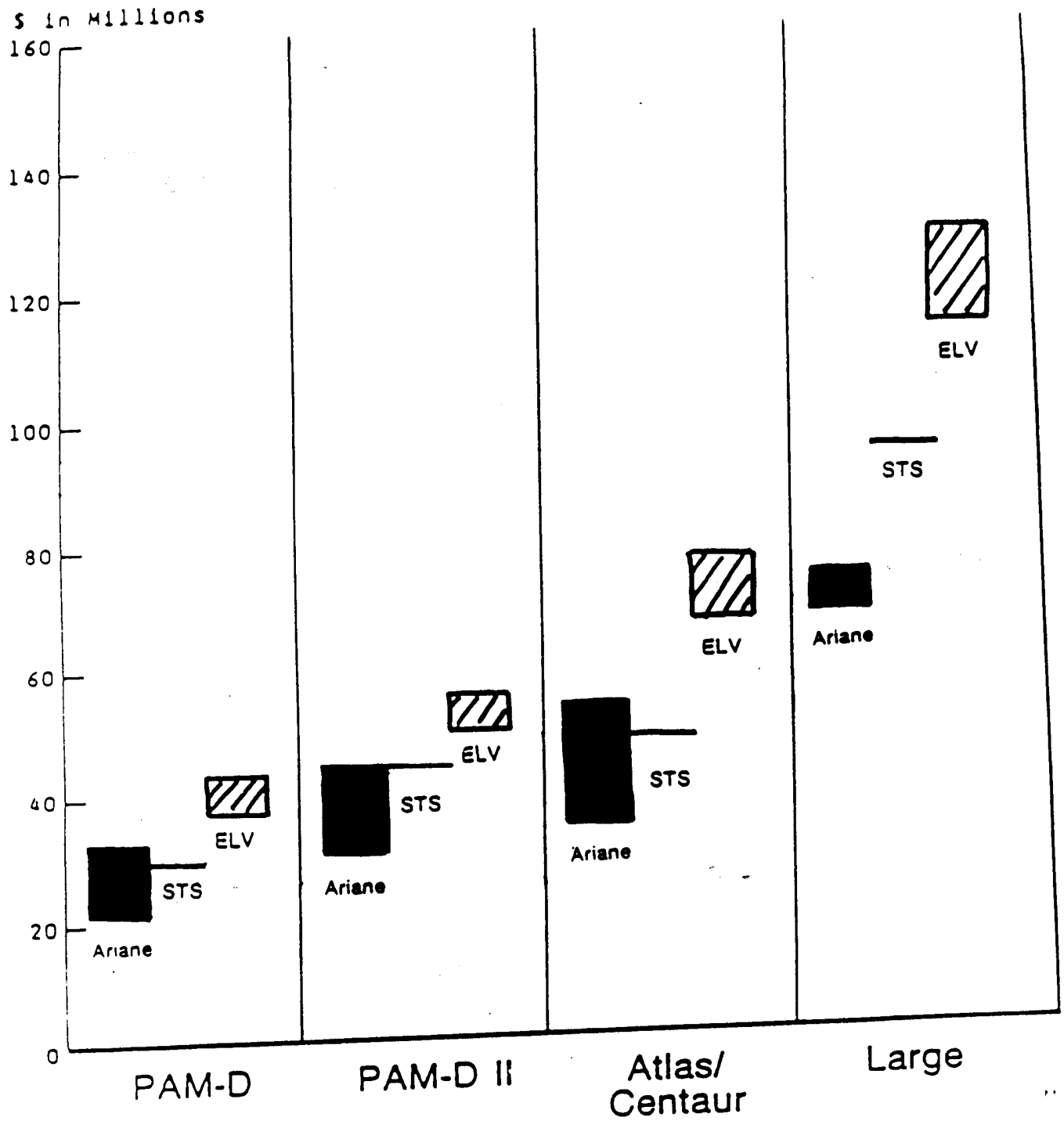
	<u>PAM</u>	<u>PAM-D II</u>	<u>Atlas/Centaur</u>	<u>Large</u>
Shuttle	30	45	48	96
U.S. ELVs	37-42	50-55*	67-77	116-130
Ariane	22-33	31-45	35-54	70-76

*There is no existing U.S. ELV in the PAM-D II payload class. The Working Group has estimated the price if such a vehicle were to exist. In actuality, to use a U.S. ELV, payloads in this class would have to fly on a larger, more expensive ELV.

The results of Table V are depicted graphically in Figure I on the following page. It can be seen that, for all payload classes, Ariane is priced lower than U.S. ELV's. And, for the heaviest payloads, Ariane has a distinct price advantage over the Shuttle as well.

Figure 1

Launch Prices by Payload Class



ASSESSMENT

The ability of the United States to maintain leadership in space transportation depends on its ability to maintain cost competitiveness with Ariane. All systems available for space launches are proven, reliable systems. Financing and insurance are available for both U.S. and European launches. Schedule availability can be a factor in selection of a launcher, but the major determinant is cost.

At current Shuttle prices of \$71M (82\$) Ariane and Shuttle are competing evenly, with Shuttle winning about half the competitive bids. With implementation of full cost recovery for the Shuttle, Ariane prices are likely to rise as Arianespace attempts to maximize its income. However, noting that U.S. ELV prices are not competitive, Arianespace officials have indicated that they will price their services in an attempt to capture the major portion of the satellite launch market if Shuttle prices rise extensively. During the early phase of Ariane operations, Arianespace was competing with the Phase I Shuttle price of \$30M(82\$) and large subsidies were required from its sponsors. At that time, such a predatory strategy would have been difficult to maintain--each additional launch contributed very little to reducing the sponsors' costs. The Phase II Shuttle price of \$71M(82\$) alleviated to a large extent Arianespace's difficulties in recovering costs to reduce the sponsors' burden. Now, with Arianespace already showing a modest profit and with its post-1987 higher prices

soon to be realized, such a highly competitive strategy is easily pursuable--each additional launch means more profit and increased economies of scale.

The full cost recovery Shuttle price submitted by the NASA Administrator for Presidential approval would provide some competition to the Europeans, particularly for smaller payloads. On the other hand, U.S. ELVs are not price competitive with Ariane in any payload class. Assuming that, for policy reasons, Shuttle prices are escalated extensively, Arianespace will be in a position to capture as much of the market as it wants.

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